

CLARKSON BULLETIN

Vol. V.

OCTOBER, 1908.

No. 4.

THOMAS S. CLARKSON

MEMORIAL

SCHOOL OF TECHNOLOGY

POTSDAM, N. Y.

ISSUED QUARTERLY BY

THOMAS S. CLARKSON MEMORIAL SCHOOL OF TECHNOLOGY

Entered January 16, 1904, at Potsdam, N. Y.,
as second-class matter, under Act of Congress,
of July 16, 1894.

1908

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Announcement: The Clarkson Bulletin is published quarterly, January, April, July, and October, each year.

It will be mailed upon application to

The Director,

Clarkson School of Technology,

Potsdam, N. Y.

REINFORCED CONCRETE AND ITS USE IN HYDRAULIC DEVELOPMENT.*

By N. R. WILLARD, B.S.**

Water power, the development of which has been made possible and profitable by the perfection of high tension electric transmission, possesses a financial value that is almost limitless. If the plant can be so constructed that the cost of maintenance shall be small, the net returns on the investment will be unusually satisfactory, for the cost of operation of such a plant is relatively a very small per cent. of the gross available income. It is because such plants are possible that the search for good and reliable water powers is engrossing much of the engineers' attention.

A power plant consists of two parts, viz., the power house, with its necessary forebay, canal, penstocks, etc., and the dam. The perfection in both of these parts has been very rapid in the last few years, espe-

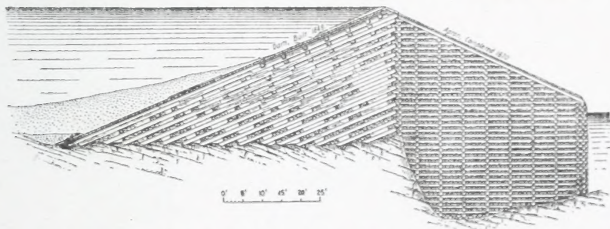


Fig. 1—Section of Old Wooden Dam. Original and enlarged cross-section of dam built across the Connecticut River at Chicopee Falls, Mass.

cially in the design and construction of the dam. It is to this latter that I wish particularly to direct your attention.

The earliest dams were built of timber and some are still being built of the same material. Before the present high price of lumber, these dams could be constructed cheaply, but in no case were they satisfactory after the first few years. Few owners of timber dams are free from an exasperating loss of water in the dry season, at a time when the water is most needed—a loss which often amounts to a serious crippling of their business. Constantly deteriorating, constantly demanding large and increasing yearly outlays for maintenance, the timber dam will be sooner or later discarded and replaced by a more

*Address before the Clarkson Engineering Assembly, November 21, 1907.

**Constructing engineer of the Ambursen Hydraulic Construction Company, Boston, Mass., in charge of the construction of the reinforced concrete dam, for the Racquette River Paper Co., Potsdam, N. Y.

staple construction wherever good business and engineering methods prevail.

The timber dam was usually built with a long slope on the up-stream side, so that the weight of the water helped to hold it in place. This type of dam is known as a Pressure Dam, in which the pressure of the water acts with the weight of the structure instead of opposing its stability. Because of this slope the weight is so distributed that the dam can be built on a foundation which will not sustain a solid dam. Figure 1 shows the section of such a dam.

It is a recognized fact that the life of a timber dam is from 20 to 30 years, which comparatively short life is maintained by a continuous expenditure for repairs. Should the dam be located in a latitude where the ice runs are heavy, each succeeding season will produce its disastrous results. The ice will cling to the deck planking and tear it from its timbering, or, tumbling over the apron will pound it to pieces. This experience is too common to need more than mention.

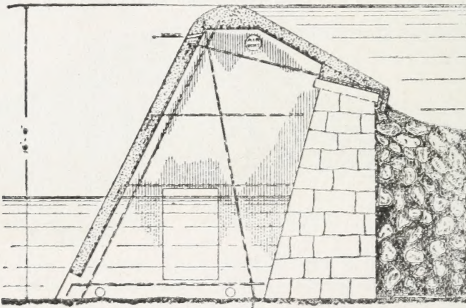


Fig. 2—Reinforced Concrete enlargement of dam at Danville, Ky.

The simplest form of masonry dams, shown in the design of the original dam in Fig. 2, is merely a stone wall built across the river, having a slight batter on the down-stream side and perpendicular on the up-stream side, to which additional stability is given by a fill of stone and clay. The dam here shown, owned by the Danville Water Works at Danville, Ky., though of primitive design, has been built but a few years. It has no stability to withstand any flood were it not for the heavy bank of rock and clay extending about thirty feet up-stream.

It became necessary to raise the crest four feet, which was carried out as shown. The transverse walls are twelve inches thick and are spaced on ten foot centers. The shell is eight inches thick and is heavily reinforced with steel rods and wire cloth. Openings through the shell and transverse walls equalize the level of the back-water. An air vent is provided in one of the abutments, in the form of a six inch iron pipe extending well above high water level. Note the proportional increase of base area of the revised design over the original construction. Near the crest of the reconstructed dam will be seen a vent pipe passing through the apron. This is inserted to overcome a defect which it was feared might exist in the new structure and would

unquestionably exist in the case of a dam of the original design. The overfall passing the crest will leave the down-stream face of the dam and in rushing away will cause a partial vacuum between the overfall and the dam. As this vacuum increases, the overfall will be drawn from its true mathematical curve of fall, the sheet of water will be broken and the vacuum relieved. Repeated occurrences of this nature cause a tremor which will always be injurious and possibly fatal to the structure.

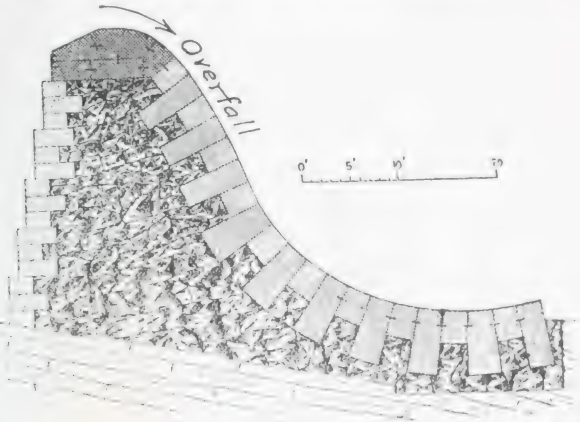


Fig. 3—Cross-section of Ogee Type of Masonry Dam built to replace dam as shown in Fig. 1.

The next step in the development of the design of the dam was to what is known as the "Ogee" type shown in Fig. 3. A dam of this type is so constructed that the overfall rests upon it during its entire descent.

The same defect exists in this structure as in that of Fig. 2, that is, the vertical upstream face against which the entire water pressure is exerted in a direction tending to push the dam down-stream. Such a dam as this one, built across the Connecticut River at Holyoke, Mass., is so massively built and its foundations so well embedded, that it will successfully withstand any flood to which it may be subjected. It is, however, a very costly piece of construction.

Fig. 4, a photograph of parts of the ruins of the Chambly Dam across the Richelieu River at Chambly, Que., shows the inherently defective design of the "Ogee" type of dam. This dam was 26 feet in height and 1600 feet in length. 450 feet of which washed away during an excessive flood. The large pieces measure somewhat more than 100 feet and are about 50 feet from their original position. The washed out section was replaced by a timber dam.

Dams of all the types considered are being planned and built, but, as in other branches of building construction, there has been a marked

advance in the architecture of these structures. Reinforced concrete, which is extensively replacing the other building materials, has been applied to the construction of dams with the result that the new type of dam is infinitely superior to any of its predecessors. The reinforced concrete dam, combining all the advantages of the older types, adds to them absolute permanence and durability, a high factor of safety which never decreases notwithstanding the amount of flood, and cheapness and rapidity of construction.

The first reinforced concrete dam, built at Theresa, N. Y., replaced an old timber dam and was modeled very closely from it. The design was substantially that shown in Fig. 5, consisting of a series of buttresses spaced 10 feet apart running back under the whole depth of the dam and supporting an inclined slab of concrete properly calculated as to thickness and reinforcement for the load imposed upon it.

The introduction of reinforced concrete as a material for the building of dams was undoubtedly the starting point of revolutionary methods in hydraulic construction. The success of the Theresa dam stimulated more elaborate research into the adaptability of this material with the result that during the next year, 1904, there was built at Schuylerville, N. Y., a dam 25 feet high and 250 feet long with cross-section as shown in Fig. 6. This type combines the design of the

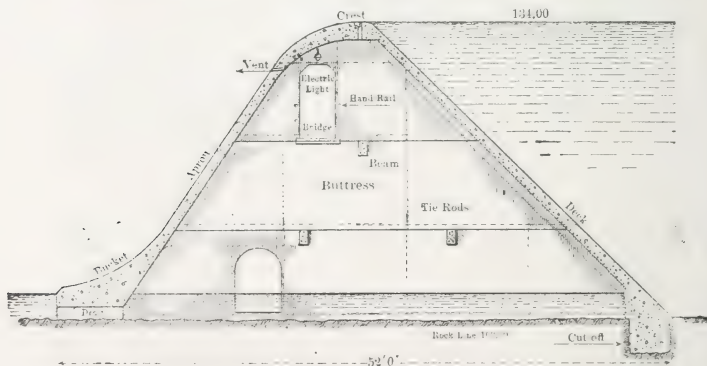


Fig. 6—Cross-section of Reinforced Concrete Dam built at Schuylerville, N. Y., 1904.

timber dam with that of the "Ogee" dam. The concrete shell, heavily reinforced is supported by buttresses, and is at all times accessible for inspection. Any chance leakage through seams in the rock can exert no upward pressure as there is no base on which to press. A drain through the toe in each bay provides an outlet for the leakage and equalizes the tail water. A particular feature of the design is the thoroughly practical electrically lighted bridgeway through the dam 16 feet above the river bed. This bridge, the only means of communication between the two banks of the river, is in constant use.

Fig. 7 shows the cross-section of the solid dam as originally designed for this site superimposed on the cross-section of the reinforced concrete dam as finally adopted. Note that the original design required extensive excavation over the entire base of the dam, while the excavation for the reinforced concrete dam was merely a trench at the heel.

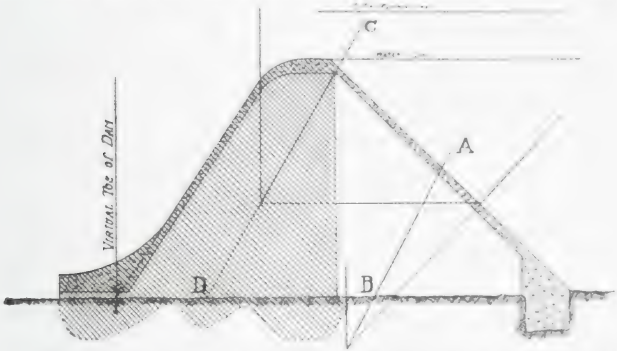


Fig. 7—Cross-section of Reinforced Concrete Dam superimposed on that of Ogee Type of same height.

heel. Later practice has demonstrated that even this excavation is not necessary, where the foundation is reasonably good ledge, provided, of course, the rock is thoroughly cleaned before the concrete is placed.

The quantity of material used in the reinforced concrete dam was about 40 per cent., of the estimated amount needed for the solid dam and its cost was about 60 per cent. The structure was built in 96 working days, which, it is safe to say, was less than half the time that would have been required for the solid dam.

At this point it will be well to consider the mathematics of the two types of dam shown in Fig. 7. There are two vital points to be determined in planning the section of a dam—the factor of safety and the distribution of forces acting on the dam. The factor of safety is the ratio between the moment of pressure and the moment of resistance, or, in common terms as applied to a dam, the ratio in which the tendency to remain in place exceeds the tendency to overturn. The forces acting upon the dam are its weight and the pressure of water. The first is a fixed quantity while the second increases in intensity as the water rises.

The effect of two or more forces acting upon a body at the same time may be represented by one force different in magnitude and direction from either force and known as their resultant, shown graphically as the diagonal of a parallelogram in which the two adjacent sides represent the two forces. It is a law of physics that if a body, resting freely on its base is acted upon by any number of forces, their resultant, if produced must pass through the middle third of the base, otherwise the body will overturn.

Fig. 8 is the cross-section of a 50 foot dam designed for a 10 foot flood. The weight of the structure as distributed over the base may be represented by the triangle B C T showing maximum pressure at the heel and no pressure at the toe. When empty, the line of pressure, R, passing through the center of gravity, cuts the middle third at its up-stream end. This then is the point of greatest stability. As the pond fills, the resultants of the water pressure and the weight of the dam, represented by R2, R3, R4, and R5, and corresponding to water levels W2, W3, W4, and W5, advance steadily and with increasing in-

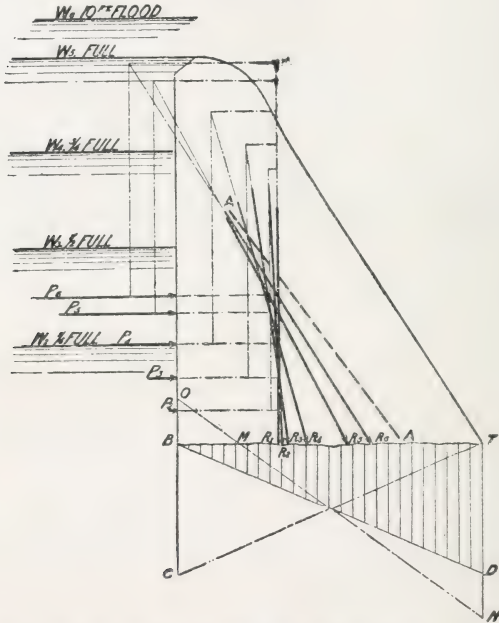


Fig. 8—Strain sheet of typical solid Masonry Dam.

clination, down-stream until, when the crest is reached the resultant is at R5. The factor of safety is then about 1.5. At the calculated height, W6, the resultant R6 has moved to the down-stream end of the middle third, the limit of stability has been reached and the factor of safety is 1. The distribution of the pressure on the base is now represented by the triangle B D T with no pressure at the heel and maximum pressure at the toe. If, now, some unforeseen flood occurs, the resultant will advance, say to A, the distribution of pressure on the base will be O N T, the base will be virtually shortened to M T and the

dam will lift at the heel. At this point the dam will be seriously weakened or will go out.

Fig. 9 shows the cross-section of a 50 foot reinforced concrete dam also designed for a 10 foot flood. In this structure, the line of pressure passes through the center of the middle third, an ideal feature. The distribution of pressure is even over the entire base, as is shown by B. As the pond fills, the resultants move slightly down-stream to R4, corresponding to $\frac{3}{4}$ filling. They then move, but more rapidly, back toward the center, through R5, to R6 which is nearly the position of the resultant of the structure itself. With an infinite flood assumed, the

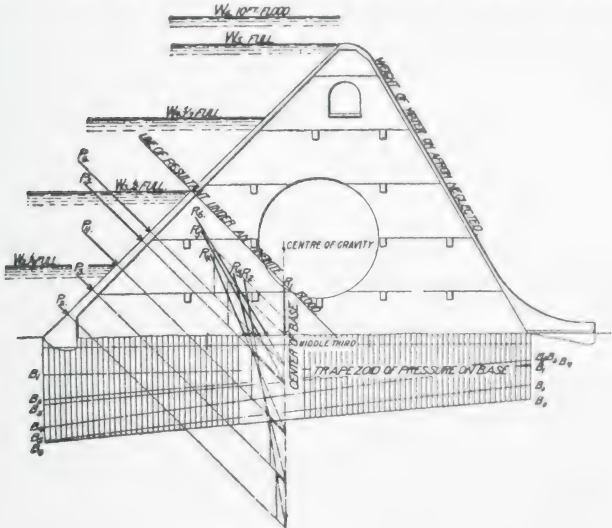


Fig. 9—Strain sheet of typical Reinforced Concrete Dam.

resultant, perpendicular to the center of the deck, still passes through the middle third, which proves that excess floods, instead of endangering the structure, actually increase its stability by forcing the resultants nearer the center of the base. The base pressures corresponding to the different water levels are shown by B2, B3, etc. It will be noted that the effect of the weight of water on the apron has been neglected. This is because it is almost impossible to determine just what effect this has, but it is very probably that B6 becomes nearly parallel with the base. While this distribution is nearly uniform it increases slightly at the heel and never decreases at any point. This indicates that the factor of safety toward overturning remains constant. There is another factor of safety, however, which presents itself in this design, namely, that of shearing or bending of the slab between the buttress walls. This is under the control of the designer by so proportioning

the concrete and its reinforcement, that it will sustain with a given factor, say 5, the highest known flood at the particular site. It may well be said, then, that the factor of safety of the reinforced concrete dam is of its details while that of the solid dam is of the structure as a whole.

A slight modification of the full apron dam known as the half apron type answers practically all the purposes of the former type with advantages of construction which reduce materially the cost of the finished structure.

Fig. 10 shows this design with its apron extending half the height of the dam and terminating in a bucket which discharges the water horizontally well away from the foot of the dam. In this dam, as in all others, a walkway may be provided and openings lower down in the buttresses allow easy access to all parts of the interior for inspection.

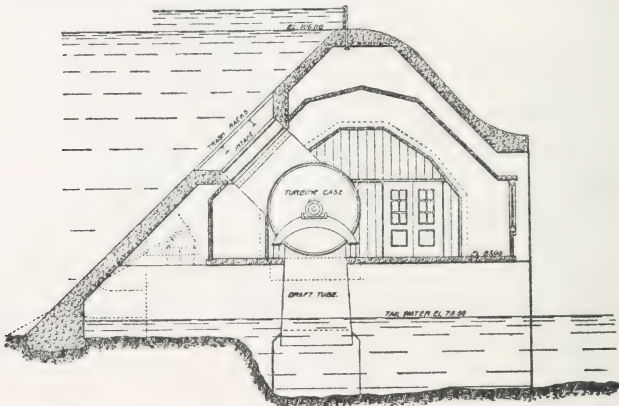


Fig. 11—Cross-section of Dam built on the Patapsco River, Md., with contained Power House.

No greater example of the adaptability of reinforced concrete as a material for the construction of dams can be found than that shown in Fig. 11. This is the cross-section of a dam built across the Patapsco River, Maryland, during the summer of 1906. The conditions were such that the power house could not be located on either bank in the vicinity of the dam. Advantage was taken of the hollow nature of the dam to place the power house within it. The cut shows plainly how this was accomplished. The walls of the power house were constructed of Ferro-inclave, plastered on both sides, and serve to enclose the machinery and to protect it from the condensation on the inner walls of the dam. This arrangement has proven satisfactory in every respect, the power house being light and well ventilated and the temperature very uniform. It contains three 500 H.P. units, is finished with hard-wood floors and the walls painted cream white, needing no apology except that the space is somewhat limited to give all the con-

venience desired, which fault would be overcome with a somewhat higher dam. Access is from either shore by a walkway substantially like that shown in Fig. 10. Since the building of this dam several other similar structures have been designed and are under construction.

Fig. 12, a type known as the curtain dam is a modification of the open front dam in which a curtain below the crest acts to stiffen the whole structure as well as to insure the ice and water falling beyond the foot of the dam. When necessary the crest is thickened and a more gentle incline is given to the deck so that the ice or logs may pass over with the least possible obstruction. A photograph of this type of dam is shown in Fig. 13. This dam, the rollway of which is 28 feet high and 200 feet long, is built across the Catskill River near Cairo, N. Y. The power house is located about 1200 feet down stream, the water being conducted to it by penstocks, the head joints of which are shown.

While the types of reinforced concrete dams so far considered are intended for ledge foundation, each may be built when such a foundation does not exist. The solid dam must rest either on a ledge or heavy piling, which latter is expensive and precarious. The relatively light weight of the reinforced concrete dam and its broad base reduce the load per square foot on the foundation to a fraction of that of a solid dam. This method of construction, is, therefore, the only alternative, except, of course the always unsatisfactory wooden dam.

In designing a dam for a site where ledge foundation does not exist, the solution is substantially as shown in Fig. 14. The dam rests upon a floor of concrete heavily reinforced by steel rods near both the upper and lower surfaces. Concrete cut-off walls are sunk at both edges of the floor or sheet piling of wood or steel is driven until either ledge or hard pan is reached. These walls prevent undermining and slipping. Any possibility of lifting from the pressure of water accumulating under the base is prevented by weep holes through the floor, the seepage from which runs off through the drains in the toe. If the bed of the river is very soft, of sand or an alluvial deposit, the scouring or washing below the dam is further prevented by paving, as shown in the cut. A core wall is extended into the bank far enough to prevent any leak around the end of the dam.

From the standpoint of design, the reinforced concrete dam meets every requirement. Inasmuch as it is strictly a pressure dam, it cannot overturn, however high the flood may be. Assuming well prepared foundations, it can fail only through the defects of its own parts by shearing, crushing, or collapsing. These points, as has already been shown, are entirely under the control of the designer. The factor of safety is whatever he may choose to make it and it will increase as time passes.

It is an understood fact that concrete gains strength and hardness through a period of many years and that it never deteriorates. The steel rods, hermetically sealed in the concrete and forming an homogeneous mass, are beyond the reach of water or any other source of injury and are as permanent as the concrete itself. In every respect, then, the reinforced concrete dam represents the perfection of the builders' art in this line of construction. It is permanent, it is strong, it is cheaply and quickly built and, by its flexibility of design, adapts itself readily to the most difficult requirements. As a prominent engineer has said, "It becomes a part of the geology."

INSTRUCTION IN MECHANICAL DRAWING.

By CLARENCE H. SANFORD, PH.B.*

The two main purposes of instruction in mechanical drawing are probably common to all such courses in the representative engineering schools. These are to train the student in the use of drawing instruments, and to teach him the theory of simple working drawings. The methods employed to obtain these results, however, are not common to all institutions. Much of the work in drawing in many of them is based on geometric forms; and in some of the courses in mechanical drawing no attempt is made to teach dimensioning or to familiarize the student with any of the qualities of a good shop detail drawing beyond the mere features of correct projection.

It is possible that the two principal results referred to above may be more readily obtained in another way, while at the same time, instruction is given in the principles of shop drawings. This newer method is to give the student from the first, typical machine and construction elements to detail, following the style of shop drawings. Nearly all of the geometric forms may be found embodied in machinery and engineering construction, occurring sometimes in simple or complicated and unsymmetrical forms. In these embodiments, the student may learn all of the principles of projection of geometric forms, while at the same time he arrives at the idea of utility in drawing work. Every detail is required to be fully titled and dimensioned, so that early in his course the student is given practice in arrowheads, dimensions and lettering. He is given to understand that a good working drawing must contain "complete information from draftsman to workman furnished at minimum cost." When he thus realizes the commercial value of his work he finds a new interest in it.

Such a course of instruction as is outlined above has been found to be far more valuable especially as a preparation for machine drawing, than a course founded on geometric forms with their variations and combinations. Actual experience has shown that a knowledge of the projection of geometric forms carries the student but a short distance in the drafting room. As a matter of fact, in a course where the models used were actual machine parts, it was observed that after about three weeks of instruction, there was little appreciable difference between the work of students who had never received instruction in mechanical drawing, and that of students who were given such instruction based on geometric forms.

Having once resolved on adopting such a method, the first question arising is that of the selection of material for study as models. The student is first to be taught the principles of simple projection, and how to use his instruments; but it is scarcely less important that he learn dimensioning, lettering and throughout all of his work observe the style of shop drawings.

The material required to develop these various results should be carefully selected. Castings, forgings, machined steel parts and construction details may be classified in several ways; (a) as to their most prominent geometric forms; (b) as to their value as subjects for ex-

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ercises in the use of instruments; and (c) as to the drafting room conventions and methods for which they may furnish illustrations. There is a wealth of material from which a suitable set of models may be selected embodying the principles of simple projection, use of instruments, and drafting room practice. Details of such a set of models, we should call typical details.

The information necessary for the student, in order that he may make a detail drawing of such a model may be imparted to him by various methods. While considering these, it must be borne in mind, that it is quite as important to get the student to think as it is to teach him how to draw. The mental training should be coincident with the development of the work and is as valuable as the manual. It may be given by exercise: (1) in getting a true conception of the object to be drawn; and (2) in interpreting that conception in two or three orthographic projections. The first exercise is called "reading a working drawing," and the second is known as making a working drawing. Instruction which does not train the student in both these directions has not reached its maximum efficiency.

Of all methods of placing before the student material for a working drawing, the most obvious is to give him the model to work from. Working drawing sketches, made freehand and dimensioned from measurements, then serve as a medium to carry dimensions from the model to the drawing board. A certain amount of this kind of work is valuable. As the storage and handling, however, of so many models is impracticable, "measuring up" is usually made a part of the later machine drawing; and an equivalent of the freehand sketch is placed in the hands of each student. This sketch may consist of one or two views of the object, more or less incomplete, yet with sufficient information given by dimensions and notes, so that a complete shop drawing may be made from the sketch.

In working from such a sketch the student must first "read the sketch," then obtain a conception of the form of the object, and later draw two or three views to scale, using the information given on the sketch. It is not claimed that these processes take place successively and separately. It is better that the student should think as he draws. It is rarely the case that a student makes three projections of an object without getting a complete conception of its form, even if all three views are given him to start with. However, to avoid the possibility that a student may draw without thinking, it is best to give complete information on the sketch in two or three views and require other views than those shown. For example, a front and top view may be given, and a sectional front view and end view be required.

Care must be taken, on the other hand, that the drawing be not too difficult for the student to read, considering the experience he may have already had. At first it is desirable to explain the method of reading, or combining the two or three views of an object, and to aid the student's imagination by perspective or isometric sketches, or by the use of models.

Material advantages may be obtained in all of this instruction by keeping the class together in their work. Explanations of important features may then be given the whole class at once. These explanations may deal with the object to be drawn, considered, (1) as to its use as a part of a machine, or as an element of construction; (2) as to

the processes necessary to its production; and (3) as to any new use of instruments or geometrical construction required to make the drawings. Hints may be given as to "reading the sketches." Drafting room conventions may also be explained.

In order thus to keep the class together, only such an amount of work should be assigned as may be well done by a majority of the class in the scheduled time. Optional drawings may also occasionally be given out to keep the faster men at work. When the scheduled time for a drawing has passed, the drawings should be called in even though unfinished. Too much loitering and "soldiering" is done in the average drafting room, when the student understands that he can come in and "work overtime" whenever he pleases.

Simple orthographic projection should be very thoroughly explained at the beginning of the course. The frequent use of a projection cage or its equivalent is of great value. Since the more difficult oblique projections and intersections are not taken up in this course, they should be dealt with as to their theory and practical applications, in the more comprehensive study of descriptive geometry.

Elements of Engineering Construction used as Models.

The following is a list of some of the elements of engineering construction which have been found valuable for us as illustrations of the principles involved: try square, lathe anchor plate, column base, planer v-block, tool saddle, tool post, crank, cast iron column, pulley, gear blank with arms, cone pulley, flanged elbow, nuts and bolts, screws, brake lever, bearings and guides, angle braces, simple pipe hanger, simple shaft hanger, assembled detail of stuffing box, assembled detail of commutator, layout and detail of a simple gangway support, steel construction.

I. Drafting Methods and Conventions.

Illustrating drafting room practice.

1. Dimensioning.
2. Use of finish marks.
3. Drawing to reduced scale.
4. Use of sectional views.
5. Variation of section lines for material.
6. Use of fillets in castings.
7. Shop conventions for threading: for showing a long piece broken, for showing a part section.
8. Conventional sectional views of pulleys, gears and wheels with arms.
9. Use of standard tables for standard parts.
10. Use of center lines.
11. Use of assembled details.

II. Geometric and Graphical Constructions.

Requiring knowledge of the peculiar uses of instruments.

1. Laying out angular dimensions.
2. Drawing of fillets.
3. Section lining.
4. Construction of hexagons, octagons, etc.
5. Laying out bolt holes in flanges.
6. Construction and drawing of ellipse, parabola, hyperbola, cycloids and involute.

NEW COURSES OF INSTRUCTION.

I. Semester. 1908-1909.

Engineering Construction, C.E. 14. A course in the elements of construction and the investigation of practical problems as they arise in civil engineering; with discussion of methods adopted by contractors in the actual work of construction. Lectures and reports. Prerequisites, Applied Mechanics I; T., 3; S., 1; (2). Professor Turrill.

Theory of Equations, Math. I. Complex numbers; DeMoivre's theorem; general properties of equations; solution of higher numerical equations; the cubic and biquadratic; trigonometric solution of the cubic; elimination. I; Th., 8; (1). Professor Barton.

Physical Laboratory, Physics 23. A continuation of courses 21 and 22. Special problems, including level and aneroid testing; calibration of thermometers; use of sextant; construction of telescopes, goniometers; measurements and wave lengths of light. Prerequisites, Physics 21 and 22. I; F., 5, 6, 7; (1). Professor Wheeler.

APPOINTMENTS ON THE INSTRUCTIONAL FORCE.

The following appointments have been made by the Board of Trustees, to take effect September 1, 1908:

Lucius Kimball Russell, S.B., A.M., to be Professor of Chemistry, vice F. M. Williams, A.M., resigned.

Mr. Russell's training and experience have been as follows:

S.B., Massachusetts Institute of Technology, 1886; Chemist in the laboratory of the North Chicago Rolling mills, 1887-1888; Water Analyst for Massachusetts State Board of Health, 1888-1892; Instructor in Chemistry at the Massachusetts Institute of Technology, 1892-1903; graduate student at Columbia University, 1903-1904; A.M., Columbia University, 1904; Teacher of Science at the Berkley School, New York City, 1904-1905; Instructor in Chemistry at Simmons College, Boston, 1905-1908. Member American Chemical Society.

Edwin Bennett Wheeler, B.S., to be Professor of Physics, and first incumbent of this newly established Chair.

Mr. Wheeler's training and experience have been as follows:

B.S. University of Missouri, 1899; Teacher of Physics, Bonje Terre (Mo.) High School, 1899-1900; Teacher of Physics, Missouri State Normal School at Cape Girardeau, 1900-1901; Instructor in Physics and in charge of the department during the absence abroad of the professor of Physics, Union College, 1901-1903; Assistant in Physics, Columbia University, 1903-1906; Instructor in Physics, Case School of Applied Science, 1906-1907; Assistant in Physics, Columbia University, 1907-1908. Member of the American Association for the Advancement of Science, the American Physical Society, and of Sigma Xi.

Sherman Marsh Turrill, C.E., to be Professor of Civil Engineering, vice Donald F. McLeod, C.E., resigned.

Mr. Turrill's training and experience have been as follows:

C.E., Cornell University, 1901 (courses in Architecture and Civil Engineering); 1901-1902, Structural Engineering with the American Bridge Co.; 1902-1903, Railroad Engineering, with N. Y. C. & H. R. R. R.; 1903-1904, Municipal Engineering, New York City; 1904-1907, Instructor in Civil Engineering, Lehigh University; 1907-1908, Instructor in Civil Engineering, University of Cincinnati; Associate American Society of Civil Engineers; Member Society for the Promotion of Engineering Education.

Clarence Horton Sanford, Ph.B., to be Associate Professor of Technical Drawing, and first incumbent of Chair established by the Board of Trustees, July 30, 1908.

Mr. Sanford's training and experience have been as follows:

Ph.B., Yale, 1905 S.; Instructor in Mechanical and Machine Drawing and shop mathematics, Pratt Institute, 1905-1906; structural draftsman and designer, Post and McCord, New York City; construction and machine design, Cambria Steel Co., Johnstown, Pa., 1906-1907; in charge of mechanical and machine drawing, Brooklyn Evening High School for Men, 1907-1908; Instructor in Mathematics, Stevens School, Hoboken, N. J., 1907-1908.

Laurence Joseph Gorman, '09, to be Tutor in Algebra, vice John Jacob Grieb, '08, graduated.

Adrian James Biche, '09, to be Assistant in Surveying, vice Hugh Max Sprague, '08, graduated.

Bryan Woodward Morse, '09, to be Assistant in Physical Laboratory.

Lee William McCullough, '09, to be Librarian, vice Rufus Lasher Safford, '08, graduated.

Loy Ellsworth Welker, '09, and George Ernest Welker, '09, managers of the Clarkson Tech. Orchestra, have been awarded a continuation of the musical scholarship, for 1908-1909, which they held for the college years, 1906-1908.

Walter Strough Davis, '10, to be Tutor in Geometry.

Lloyd Woolsey Weed, '10, to be Assistant in Surveying.

Albert Darius Merrill, '10, to be Assistant in Technical Photography, vice John Philip Schrodtt, '08, graduated.

John Alfred Remington, '11, to be Pianist.

RECENT APPOINTMENTS OF CLARKSON GRADUATES.

1901.

William H. Wilcox, B.S. in Civil Engineering, Inspector, Village of Saranac Lake, N. Y.

1905.

Albert L. Sayer, B.S. in Civil Engineering, State of New York Improvement of Public Highways, 512 Roth Bldg., Watertown, N. Y.; mail, 14 Rensselaer Ave., Ogdensburg, N. Y.

1906.

Carl C. Ahles, B.S. in Civil Engineering, State Engineer's Office, Herkimer, N. Y.



FIG. 4. RUINS OF CONCRETE OGEE TYPE OF DAM BUILT ACROSS THE RICHELIEU RIVER AT CHAMBLY, QUEBEC.



Fig. 5 — TYPICAL CROSS-SECTION OF SIMPLE REINFORCED CONCRETE DAM ON LEDGE FOUNDATION.



Fig. 10 — TYPICAL CROSS SECTION OF HALF-APRON REINFORCED CONCRETE DAM ON LEDGE FOUNDATION.



Fig. 12—TYPICAL CROSS-SECTION OF CURTAIN REINFORCED CONCRETE DAM
ON LEDGE FOUNDATION.



Fig. 14—TYPICAL CROSS-SECTION OF FULL APRON REINFORCED CONCRETE
DAM ON SOFT FOUNDATION.



FIG. 13—REINFORCED CONCRETE CURTAIN DAM AS BUILT ON THE CATSKILL RIVER AT CAIRO, N. Y.

Frank H. Flint, B.S. in Civil Engineering, State of New York Improvement of Public Highways; 512 Roth Building, Watertown, N. Y.

Rodger D. Flint, B.S. in Civil Engineering, engineer and inspector, with Pennsylvania Terminal and Tunnel R. R. Co., First Avenue and 33d Street, New York City; mail, 110 Madison Ave., Flushing, N. Y.

1907.

Maurice F. Dullea, B.S. in Civil Engineering, State of New York Improvement of Public Highways; mail, 25 University St., Rochester, N. Y.

Ray D. Wiswell, B.S. in Civil Engineering, State of New York, Improvement of Public Highways; 512 Roth Bldg., Watertown, N. Y.

1908.

John Jacob Grieb, B.S. in Mechanical Engineering, Instructor in Mechanical Engineering, New Mexico College of Agriculture and Mechanic Arts, Agricultural College, (P. O.), New Mexico.

Roy F. Hall, B.S. in Civil Engineering, State of New York, Improvement of Public Highways; mail, 134 Ford Street, Ogdensburg, N. Y.

Joseph R. Hardenbergh, B.S. in Electrical Engineering, Utica Gas and Electric Company; mail, 214 Hicks Street, Utica, N. Y.

Charles L. Hinds, B.S. in Mechanical Engineering, L. S. & M. S. R. R. Co.; mail 563 E. 103d St., Cleveland, O.

Jerry P. Lynch, B.S. in Civil Engineering, New York State Barge Canal, Residency No. 5, Sylvan Beach, N. Y.

Charles S. Merriman, B.S. in Electrical Engineering, Heuvelton, N. Y.

Karl Moulton, B.S. in Civil Engineering, Oliver Mining Company, Coleraine, Minn.

Rufus L. Safford, B.S. in Civil Engineering, State of New York Board of Water Supply; mail, Potsdam, N. Y.

John P. Schrodt, B.S. in Electrical Engineering; Electrical Testing Laboratories, 80th Street and East End Ave.; mail, 111 East 85th Street, New York City.

Hugh M. Sprague, B.S. in Civil Engineering, City Engineer's Office, Great Falls, Montana.

Everet G. Tracy, B.S. in Electrical Engineering, Stanley-G. I. Electric Manufacturing Co.; mail, 87 Woodlawn Ave., Pittsfield, Mass.

ALUMNI PERSONALS.

1902.

Rea M. Gordon, B.S. in Mechanical Engineering, has recently been testing out a centrifugal pump plant, made by I. P. Morris Co., of 30,000,000 gallon capacity, per 24 hours, in which the pumps are direct-connected to nine horizontal Curtis steam turbines.

1905.

Clinton A. Curtis, B.S. in Civil Engineering, with the New York State Engineer Department, is located at Fort Miller, N. Y., in charge of Contracts Nos. 3 and 7, of the barge canal work.

1906.

Ralph B. Leonard, B.S. in Electrical Engineering, with the Utica Gas and Electric Company, writes:

"A year ago I did not think I would be in the meter business as I am to-day. From April 15, 1908, to the present time, we tested, outside, about 3400 meters, and inside, about 1600. The meters are of all makes and some have never been tested from the day they were put in, and were found in bad shape. This year has been the first along the line of periodic testing, and it is a case of getting things into line. My work is the planning and overseeing this testing; the setting, renewal, and reading of the meters. I suggested last spring that we use another kind of meter-reader's slip, which was adopted."

1907.

Leon C. Craig, B.S. in Civil Engineering, Assistant in the civil engineering department of Guanica Centrale, Mayaguez, Porto Rico, writes:

"In this country a Central, or Centrale, means a large factory where sugar cane is crushed and raw sugar and molasses made from the juice. Guanica Centrale is the largest sugar making company in Porto Rico, and one of the largest in the West Indies, with a yearly output of about \$4,000,000 worth of raw sugar. This company is interesting from the fact that it has been built up by American and German capital entirely since the Spanish-American War, and almost on the very spot where the American troops first landed, in 1898. The organizers of the company were quick to take advantage of the fine location, good shipping facilities, etc., of Guanica Bay. They have here, in a country at first almost a desert, built up a thriving industry which serves as a fine example of business enterprise since American occupation.

"The company employs ten or twelve civil, electrical, and mechanical engineers; and three of the civils, including myself, have been engaged upon a topographical survey of a large section of cane-growing land owned or controlled by the company. Up to the present time we have surveyed and mapped about 60,000 acres, and have about 18,000 acres more to finish. On our map we have located all rivers, streams, public roads, railroads and property lines. The location of each owner's property lines, no matter what size the property may be; the obtaining of the acreage, in each piece; and the progress of the survey through a country of hills, valleys and mountains have involved a great deal of labor. But it has proved a good experience for the young engineers."

David D. Thomson, B.S. in Civil Engineering, with the State of New York, Department of Public Highways, has just completed the construction of a fifty-thousand dollar State road, and at present is working on the final estimate, which he hopes to be able to hand in, within a few days. The road, after careful inspection, has been accepted by the State and has been pronounced the best in Dutchess County. As soon as his estimate is finished, he expects to go to Tarrytown, N. Y., and there have charge of the completion of the Tarrytown-White Plains-Rye road, on which there is about two month's work remaining to be done. He will then get out the final estimate there.

1908.

Jerry P. Lynch, B.S. in Civil Engineering, located at Sylvan Beach, N. Y., Residency No. 5, of the New York State Barge Canal, has been busily engaged with the men on the State's corps of engineers, on Contract No. 4. He writes:

"I have been placed on all sorts of work since I came (June 15, 1908), but have been on concrete construction the greater part of the time. If there are any men near here with whom you would care to have me get in touch, in the way of lining them up for next fall, I would be only too glad to do so. I know that when September comes I will feel like getting in line myself, and 'On to Clarkson' for another year; but I have had my time, and must be content to stay here and apply what I have already acquired.

"Am spending a busy summer this year, doing all sorts of work, one day in concrete, next in sinking cribs, and usually about every third in the office. You can see that I am getting good experience.

"Our engineering force has recently been cut down thirty per cent, and the rest of us are left heavily loaded, especially at this time of the month when we get out a monthly estimate. Am at present on State force account work, that is, keep the time of the contractor's laborers on the different kinds of work; and this, with the wages paid, gives us a fair knowledge of what work costs."

Karl Moulton, B.S. in Civil Engineering, with the Oliver Mining Co., Coleraine, Minn., writes:

"Coleraine is a town three years old, located in the central part of a large territory which will be developed rapidly in the next few years. It is seventy miles northwest of Duluth, in the western part of the Messabi range.

"A large part of the iron ore consists of low grade ore which will have to be washed. For this purpose we are getting up the details for a washing plant, the estimated cost of which is about one and one-half million dollars. It will be capable of washing from seven to ten tons of ore, at a cost of approximately eight cents per ton.

"A little idea of the extent of the preliminary work now being done, can be had when one is told that the Oliver Mining Co., (United States Steel Corporation), has appropriated over ten millions for that purpose alone.

"At present, they are stripping the ore deposits at the rate of 15,000 cubic yards per day. This stripping has been going on for three years, consequently a great change has been made around here in the face of Nature. Houses are being built where a year ago they would have been a hundred feet in the air, a small lake is being slowly filled up, etc."

John P. Schrodtt, B.S. in Electrical Engineering, in the Electrical Testing Laboratories, 89th Street and East End Avenue, New York City, writes:

"My experience in this business has been so short that I can hardly give you a good view of the situation, but will endeavor to do the best I can. The work of a testing laboratory which does commercial work is of all kinds. In general, it is supposed that it is organized to make tests on instruments, machines, insulations, resistances, etc., and not to do any repair work. In many cases an instrument is sent in to

be corrected with the standards because it has been handled by inexperienced men and possibly ruined. I call to mind an indicating wattmeter which was to be corrected. When received the moving element was off the jewel and one of the leading-in springs was badly twisted out of shape. An instrument like that cannot be compared with the standards before some repairs have been made. This shows what is expected at the testing laboratory.

"In some respects the work here is much like the work in the laboratory at the Tech., only on a large scale. In making a test one must note all peculiarities. If the desired results are not obtained he must look around for trouble and report it. In making out the report of a test great care must be taken. Only the results of the test are to be reported and no others. A description must be given of the apparatus which was used to make the test, and the conditions under which it was carried out. The time required to make the test must also be reported.

"In doing commercial testing one does not know what may be the nature of his next job till he receives it, and then he must be prepared to use the proper method of doing it. A good way to do this is to use the principles you have already learned and common sense."

Hugh M. Sprague, B.S. in Civil Engineering, located with the City Engineer, Great Falls, Montana, writes:

"When I left Potsdam I promised to let you know how I liked the West, and something about the work I entered.

"My duties? Well, I think I could tell you what they are not, better than what they are. The first week I was in Great Falls, I worked with two United States Government Experts on cement. The soil in this locality is very alkaline, and these men were investigating the effect of alkali substances on the concrete. In the city there are several miles of large sewers, 6 feet in diameter, constructed of concrete, and some exterior action has caused a marked disintegration of the concrete. Under the action of alkali substances, or whatever it may be that is causing the disintegration, the concrete becomes soft and crumbles like lime mortar.

"At first, the engineers here thought the action did not take place unless the concrete was fresh; but the City Engineer exploded this theory by burying a concrete sewer pipe that had set hard, 6 months old. After being buried about three months, he took it up, and it could be broken easily with the hands. For a short account of what the City Engineer has done towards this investigation, see Engineering News, July 23, 1908, pages 99-101.

"If it is the alkali soil that has caused this disintegration, people who live where alkali substances are thus found should exercise great care how they use concrete. The action was greatest where the exterior soil was alternately wet and dry, the same as the action of water in decaying wood. If we get any results out of these investigations will let you know.

"The remainder of the time I have been here, I have had a chance to do about everything that is found in a City Engineer's office, making and driving stakes to running instrument, drawing maps, preparing specifications, etc.

"Now just a word as to what Great Falls is like. Great Falls is on the Missouri river, and has population of about 25,000, and is grow-

ing rapidly. At present, there is developed about 50,000 H.P., and there is work under way that will develop practically 400,000 H.P. more. This work will be completed in 1911, if everything goes as planned. We also have the largest chimney in the world, 506 feet high, 40 feet in diameter, at the top, nearly completed; cost \$200,000. It is used in connection with the large copper smelter. Last, but not least, is what is known as Giant Spring. This spring has a constant steady discharge of nearly 500 cu. ft. per second; larger than the discharge of St. Regis river."

Everet G. Tracy, B.S. in Electrical Engineering, is in the transformer department of the Stanley-G.I. Electric Manufacturing Co., Pittsfield, Mass.; and has recently been engaged in the re-wiring of a large part of the power house, owing to changes which had to be made on account of enlarging the plant.

Experiences on the Road to Work.

(Note.—The following is an account of the experiences of a Clarkson graduate in the travels incident to what he has called "Job Hunting." They are probably not altogether singular nor unique. They are surely not such as to cause undue alarm on the part of any Tech. graduate. Such experiences could be duplicated in the case of many young men, whether college graduates or otherwise. Nevertheless, the events do serve to show the interesting human together with the matter-of-fact business side of the proposition; and the kind of appreciation and treatment which the engineering college graduate may reasonably expect, even in such times of industrial depression as those now passing. The abstract has been revised by the writer, and published with his consent.)

"My dear Director:

"I received yours of this morning. I was going to write you last night, but thought that I would wait until this morning to see if I wouldn't hear from the ——— question, and be able to write more news.

"First, for business and then for news. You have my correct (home) address, for the present. I have no news for the Bulletin this time. Probably will be able to attend Founder's Day Exercises, and you may be sure I will if possible.

"I thank you very much for sending the telegram. The agency sent an application blank to fill out and I sent it in the return mail. They informed me there were two positions. I will let you know the result, as soon as possible.

"While in New York City one day, I passed by ——— on my way to the 59th street station of the Interborough Rapid Transit Co. I couldn't resist the temptation to call on 'Johnnie', as he used to be known to us, when at Clarkson. He is the same as ever, and was very glad to see me. I had a short visit and he inquired about you all.

"Editor ——— I have known for some time, and he introduced me to Mr. ———, the associate editor. They gave me letters to several prominent men. In the travels incident to 'Job Hunting' I met several other officials. Mr. ———, President of ———, was very cordial and gave me good advice, and furnished the cards for me to visit several plants. Mr. ——— of the ——— R. R. was also very pleasant.

"From the first of September till the eighth of October, I was on the go early and late. I visited about seventy-five different places, learned a great deal about getting a job, and saw several power stations and factories. They all said that business was picking up, but very slowly.

"The _____ Corporation officials were exceedingly kind, even so far as to take me out to lunch. It was very amusing. One of them wanted me to be sure to ask for the _____ division, if I got a place with the corporation; another wanted me to go on his division. The trouble is this: they need more men, but cannot get consent to take them, on account of money being scarce. They told me that they thought I could get in about December first.

"When I returned, I came by boat to _____. I stopped off at _____ to see the fellows. Work is something fierce. Almost everyone is expecting to lose his job any time. They have commenced laying men off again.

"O, yes; I met _____ and he promised to consider me in tunnel work, when there was a chance. I am, Very truly yours,

C. T. A."

THE CLARKSON ENGINEERING ASSEMBLY.

By HERVEY N. SCOFIELD, '09, SPEAKER AND CHAIRMAN OF THE LOWER HOUSE

The Clarkson Engineering Assembly, now in its second year of existence as an incorporated representative body of students, alumni and faculty, occupies a unique position among college organizations. It is the outgrowth and development of the student and faculty committees, organized to prepare a fitting celebration of the Decennial anniversary of the founding of the Tech, commemorated on November 30, 1906; and later to devise ways and means of securing a more thorough and effective working basis of all interests represented. By its legal incorporation, May 29, 1907, under a limited Charter of the University of the State of New York, and the adoption of a carefully prepared constitution, the Assembly has become a permanent, working organization with large potential powers.

The Assembly is composed of a Lower House of elective student representatives, and of an Upper House of elective alumni members and of the appointive members of the Instructional Force. These two houses have power to pass legislation governing the various phases of Tech. life and work, within the purview of the constituted authority of the Assembly, and subject to the final approval of the Director.

The Assembly is now the legal custodian of the Tech. Gymnasium building fund, and it has in hand the promotion of this project. It takes an active part in the celebration of all of the Tech. commemorative exercises, such as Founder's Day and Charter Day. Through its agency speakers of prominence in engineering, educational, and scientific lines of work are brought before the school community. Under its auspices a series of musicales have been given by the Tech. orchestra; receptions held for the Teachers' Institute meeting at the Tech., and concerts for the benefit of the Gymnasium building fund.

The aim and idea in organizing the Assembly were that it should be an active self-governing body of the Tech students, co-ordinate with

the Faculty administration, responsive alike to the needs of alumni and of students; and that it should have a real voice and vote in the inter-relations of these three constituent bodies. Its function is to bring to the Tech. a thoroughly representative form of institutional government, and to secure for the advancement of the Clarkson Memorial and the promotion of all of its interests those united and harmonious efforts essential to success.

Up to the present time the Assembly has not availed itself of the large powers which inhere in it by virtue of its charter and constitution. It exists at present as an organization fitted to cope with any emergency within its jurisdiction. That it may achieve the ideals that were conceived for it from the beginning, and become an instrument for the greatest and most lasting good in the life of the Clarkson Tech, it must have the earnest and conscientious labors of all of its members, and the unqualified support of the students, faculty, and alumni.

THE YOUNG MEN'S CHRISTIAN ASSOCIATION.

By HARRY R. JONES, '10.

The work of the Young Men's Christian Association of the Clarkson Tech. for the past year, has been the most successful since its organization, in 1904; and the new year just begun looks even more promising than the last. This is shown by the increase of attendance at the meetings, which is at least one-third greater than last year. It is not simply by the increased attendance, however, that we have evidence of an aroused interest; but it is further evidenced by the fact that in addition to those from the entering class, which naturally increase our membership, there are several from the sophomore and the upper classes who are coming this year for the first time, and becoming regular attendants. These conditions, incident to healthy growth, are sure to create further interest in our aims and welfare, and lead to more active participation in the work of the Association. We feel the loss of several members of the last year's graduating class, who were especially instrumental in the organization of the Association, and to whose untiring zeal is largely due the present condition of the Association. We see no reason therefore why the organization should not flourish, and carry forward the work so well begun.

In planning the work of last year, it was the aim of the committee to select topics pertaining to the practical side of religious life, with the idea that more benefit might be derived by the individual members in the consideration of questions which deal with the every-day life of the college student. In making out the topic cards, several dates were left to be supplied, for the purpose of securing leaders outside of the Association. Thus, we were fortunate in having Rev. J. M. Steele, Rev. E. M. Wilson, Rev. F. L. Masseck, Prof. F. L. Owens, and Prof. S. G. Barton, as leaders, and the help and encouragement received at these meetings prompts us to a repetition of the plan for this year.

As a further means of increasing the efficiency of the organization, we have for several years past sent delegates to the annual conference of the Young Men's Christian Association held at Northfield, Mass. We realize the necessity, in Christian work as well as in that along engineering lines, of keeping alive to the progress about us.

A cordial invitation is extended to the Faculty and the student body, to attend the meetings of the Association, on Friday evenings at seven o'clock, in the Tech. Chapel.

Y. M. C. A. Topics, I. Semester—1908-1909.

- Oct. 2—The roots of Christian character. James 1:27; Matt. 25: 31-40. H. M. Merriman.
 Oct. 9—A call for Christian character. Job 29. H. N. Scofield.
 Oct. 16—Characteristics of a man. I. Truthfulness. Ex. 18:21; Col. 3:9. H. G. Corwin.
 Oct. 23—Characteristics of a man. II. Decision. Heb. 12. G. D. Cowle.
 Oct. 30—Characteristics of a man. III. Freedom. G. C. Wood.
 Nov. 6—Characteristics of a man. IV. Progress and Patience. Phil. 3. J. M. Cole.
 Nov. 13—Characteristics of a man. V. Tenderness and Charity. Eph. 4:32; I Cor. 13. H. R. Jones.
 Nov. 20—Characteristics of a man. VI. Faith. Heb. 11. J. L. Maynard.
 Dec. 4—Characteristics of a man. VII. Purity. I John 3:3; Eph. 5. J. S. S. Jones.
 Dec. 11—Characteristics of a man. VIII. Service, Living use of Life. Luke 10. L. H. Willson.
 Dec. 18—The manliness of Jesus. L. W. Weed.
 Jan. 8—Life. John 3:14-16; 10:21, 28. J. C. Cowie.
 Jan. 15—Reserve Power. Matt. 14:23. A. H. Emerson.
 Jan. 22—Supplied.

THE CLARKSON ATHLETIC ASSOCIATION.

BY GEORGE M. RODGER, '09, PRESIDENT.

The Clarkson Athletic Association is an organization to promote the physical training of the students. This is especially essential for the engineer. There is no other profession with the possible exception of the military which requires as much physical training together with mental training, as does that of engineering.

Any member of the School is eligible for membership in the Association. The Athletic Council consists of seven members from the Association; one representative from the Faculty, the president and treasurer of the Association, and one representative from each of the four classes. The Council has general supervision over all athletics, the awarding of numerals and "C's"; and passes upon the eligibility of players, the schedules for games, etc.

The annual meeting of the Association was held, Monday, October 12, 1908, for the election of officers and transaction of business. At that meeting it was decided that no foot-ball team would be put in the field this year. With the excellent material now in the Tech., there can be no reasonable doubt but that next year we will be able to support a team that will hold its own with any of the teams from the other colleges in this section of the country.

It is almost impossible to secure a suitable place in which to play basket-ball. A committee has been appointed which is now making

arrangements for leasing a building which may be adapted for basketball practice. Next year, however, we hope to have a good gymnasium.

At games of base-ball, Clarkson Tech. has always made a good showing, and this year will prove no exception. An effort will be made to secure more games here in the spring than there have been in the past.

One great hindrance to athletics, at Clarkson, is due to its distance from other colleges, and consequently the great expense which it is necessary to incur in sending teams so far. We hope to do away with this to some extent this year, however, for good teams are always able to schedule games, no matter where they may be located.

CLARKSON TECH. MUSICALE.

The first musicale of the year was given by the Clarkson Tech. Orchestra, Monday evening, September 21, 1908, in connection with the reception under the auspices of the Clarkson Engineering Assembly, given to the Teachers' Institute of the Third Commissioner's District of St. Lawrence County. The following program was rendered:

Musicale Program.

March—The Gladiators.....Von Blon
Overture—Stradella.....Flotow
Vocal Solo—Selected.

L. H. Sisson, '10.

Selection—Merry Widow.....Lehar
Violin Solo—Humorske.....Dvorak
Miss Alice W. Crane.

Selected—Polish Dance.....Schwanenki
Vocal Solo—Selected.

Miss Irma Rasmussen.

Finale—Napanee.....Werner

The second musicale was given on Thursday evening, October 15, 1908, by the Tech. Orchestra under the auspices of the Clarkson Engineering Assembly, at which the following program was rendered.

Musicale Program.

March—Under the Banner of Victory.....Von Blon
Overture—Algeria.....Herbert
Vocal Solo—Selected.

L. H. Sisson, '10.

Egyptian Intermezzo—Zallah.....Loraine
Selection—Gingerbread Man.....Sloane
Characteristic—The Whistler and his Dog.....Pryor

THE SENIOR CLASS.

BY BRYAN WOODWARD MORSE, '09.

Long or short as the past three years of our course may have appeared to us, it is with no small feeling of regret that we enter the work of our last year, realizing that it means the active end of our days at the Clarkson Tech. Through what we have passed, no doubt,

will leave its impression upon our life not less indelibly than the experiences yet in store, or the problems demanding execution from us as seniors.

The senior year is also a time of somewhat sober retrospection, comforting in its assurance of things accomplished, or otherwise depressing because of duties left undone, or of opportunities neglected.

As in the processes of nature the period of fruition and of harvest is the time of expectancy and of hope, so with us the anxious thought of what the future may have in store for us will greatly agitate our minds. Nevertheless, there are so many other Clarkson men who have gone before, year after year, that we rest assured there will be room in the world for those of us who are to follow them.

When we entered the Clarkson Tech. we numbered twenty. Though small in numbers when compared with the classes of recent years, may we not with pardonable pride state that we have never been beaten in the various events which make class history. For the three years past our men have won their laurels also along the lines of school functions and activities, and maintained the standard they set in the first year.

During our freshman year steps were taken by the Tech., in which we heartily joined, towards the organization of the Clarkson Engineering Assembly, the observance of the first Decennial Anniversary of the Institution, and the development of the Gymnasium project. Our Junior Prom. set a high standard for similar functions in the future, and it was seriously commented upon as the finest event of its kind in the history of the Tech.

Moreover, as with all true Clarkson men, our aim and ambition in the years past have been, as will be our fondest hope for the future, the unification of Clarkson interests, a true esprit de corps, of the Clarkson Tech. for the Clarkson Tech.

This year we have endeavored still further to make useful and desirable history; and in an unassuming manner we have tried to inaugurate various college customs, which seem to characterize the college spirit of progressive twentieth-century institutions. By the introduction and the expected continuance of such customs we purposed to lay broader and deeper the foundation towards the training of all-round Clarkson engineers, intellectually, morally, and physically. What benefits are to be derived therefrom we must leave for under-classmen to decide, as we can but voice our sentiments and the sense of conviction of having started in the right direction and in the interests of all concerned.

This year we number fourteen, eleven of whom are of the original class. Of the three remaining, two joined our class, as juniors, being themselves college graduates, and one joined us this year, as senior, returning to the Tech. to complete the four year course. With us as with all other college men of the day, there has been a demand from the beginning, for constant effort to make good. Our losses of very desirable members were sustained through unforeseen or unavoidable causes, financial or otherwise. The absence of former members of our class we feel the more keenly as we approach graduation day, but we extend to them our sincerest wishes for success in their present stations of life; and we trust that some of them, at least, may find their way clear to join again the ranks of Clarkson engineers.

To those who have so nobly assisted us here, and inspired us with the hope that we may be able to uphold the standards and maintain the prestige of former Clarkson graduates, we shall only too soon bid adieu. We begin to realize that to all of those with whom we have been brought into contact at the Tech. we owe an obligation for the experience and the training which we have received, an obligation with a privilege, which shall stand us in good stead for the years to come.

To our fellow-students who remain, we leave the heritage of a worthy Clarkson spirit, and the ideals of striving for the right and of accomplishing those purposes which we have endeavored to establish and to maintain, so that when our earthly existence is remembered only by our footprints in the sands of time, we shall have departed with the comforting thought that "men may come and men may go, but Clarkson goes on forever."

THE JUNIOR CLASS.

BY JERRY J. MERITHEW, '10.

Knowing how well the merits of the class of Nineteen Ten have been set forth in the Clarkson Bulletin, by its earlier historians, Newton and Weed, we will not attempt to write its chronicle, for this year, in prose.

When first we entered Clarkson Tech.,
We numbered twenty-eight;
And though we're not the greatest, yet
We are acknowledged great.

Just now we number twenty-two,
Which 'bodes no ill, I know;
We're up to date, right on the job,
And wise and wiser grow.

Athletics? No! It's not our forte—
Defeated we might be;
But when it comes to brains;—ah, then
The other Techs. will see!

And whether it be in E. E. 1,
Or even in A. M. 2,
We pray don't draw the line too close,—
The A. T. M. we'll do.

Or should there be real work to do,
By play that's right and fair,
Class Nineteen-ten is just the one,
Of which each man is 'ware.

Yell, "Yippety-Yen and Yippety-Yen!"
And let the yell be long;
Its "Nineteen-ten and Nineteen-ten,"
Oh, shout it loud and strong!

THE SOPHOMORE CLASS.

BY LEWIS LEONARD DOLLINGER, '11.

One year has elapsed since we, as freshmen, entered the Clarkson Tech., and proudly we review now, as sophomores, our record, so unique in the Tech. annals and so rare at colleges in general.

With our first roll call of forty-five members we wrested from the class of '10 the claim of being the largest class in the history of the Tech. Michael Regan, a veritable "Teddy", and quite familiar with Tech. customs and therefore the better able to lead us to victory, was chosen president. Trusting in the ability of marshalling our forces, and with the buoyant spirits of men banding together, we resolved to offer the utmost resistance to sophomore domination and to demonstrate that not only quantity but also quality was inherent in our ranks.

In the first test of our mettle in the Chapel rush we easily carried off the victory. Again, the dawn after Proc. Night, revealed more depictions of the "Puny Saffron Hued" than of "Mother Love." And as a climax in the "Racket on the Raquette", the cold water bath was administered on the out-generalled sophomores most lavishly and unceremoniously.

In celebration of these victories a banquet was held at the Albion. The several courses which were out of sight in quality were also out of sight in respect to place before the men of '10 got wise. Marshalling their forces they sought to break up the banquet. How they succeeded may be learned from Sisson who got inside, and who to this day, remembers his treatment as prisoner.

In the contests also, where numerical advantages and superiority were eliminated, the scores of 5 to 0 in the foot-ball, and of 11 to 6 in the base-ball games, both in our favor, tell their own story.

In social life, the class of '11 was not found wanting. Every Tech. function, reception, entertainment, dance, etc., was not only heartily supported by our large attendance, but we also gave dignity to those occasions by a bearing and conduct becoming the young engineers of the twentieth century.

The counsel of the upper classmen has been duly considered; with the wishes of the Faculty we have complied; the aims and ideals of "Clarkson" we have endeavored to promote.

After the summer vacation we returned to the Tech., with mutual greetings. It is truly a pleasure to clasp the hands of those made dear by daily associations and comradeship, of those with whom we feel we are united by the bond of the same sentiment, interest, and aspiration. Moreover, we have returned to win more laurels, to solve greater problems, and to make more friends; but at this year's roll call not all responded. Time has wrought changes. There are at present thirty-five members. Of the absent, we would speak briefly, as follows: Clute is cultivating his exceptional musical talent in Rochester; Fellows follows agriculture; Kilbourn, Shea, and Woods are at St. Lawrence University; Leonard is at Cornell, and Malterner at Pratt Institute; Visger is developing his gold mines; Weed is attending the University of Illinois. While we miss their genial company, we accept the decree of fate that not all are to be engineers. We wish them all success and pleasure in their new work.

Of Ross Myron VanBroeklin, who lost his life last May, by accidental drowning, the student body deeply mourns the loss, and can but feel the lasting impress of his exemplary Christian life.

We were glad to meet the freshmen who are to follow in our footsteps and to show them the way of a "Tech." As to the cane rush and track meet, we, as victors, admire their courage and good showing in regard to the banquet which they so secretly planned, and cleverly carried through, we cheerfully accredit them with qualities that lead to success.

This year finds us here with a better realization of what a college training stands for, a better knowledge of what a technical education is able to provide. We are here to learn how to be workmen who need not to be ashamed; to learn how to harness the forces of nature in the interest of mankind; to fit ourselves to lead lives of usefulness, that when our course is run we may say with Horace Mann, that we have not lived in vain. To these ends we join the other classmen in an effort.

To bear the Clarkson banner
Where never yet unfurled;
To spread the Clarkson spirit
All over this wide world.

THE FRESHMAN CLASS.

By PAUL H. WOODWORTH, '12.

When the class of 1912 entered the Tech., they found that the keynote of college life here was to "do something". Although greatly outnumbered by the sophomores, we sounded the alarm on them the first evening. The hard-fought scrimmage which followed on Main Street was a contest of brain against brawn, and the result was naturally water on the brain. We were severely handicapped by lack of numbers, but soon after we seized a "Golden" opportunity to put two brawny sophomores into the tank.

On the following morning, instead of the customary Chapel rush, we held a cane rush. The result was 14 to 7 in favor of the sophomores, but as we were outnumbered again and in about the same ratio, we were satisfied with the outcome.

On Friday evening, of the same week, the class of 1911 posted about the town a code of rules and regulations for our benefit. These we promptly destroyed and substituted a new code. Since that time a great improvement has been noticed in the conduct of the sophomores.

The only law we believe which was broken was in regard to sophomores riding on the 'Bus to the station. We did not enforce this particular law, as they deserved a ride to the midnight train for their faithfulness in watching for the freshman banquet. Baron must have been thus rewarded, on the night of October 8th, as he was very sleepy when we informed him that the freshman banquet had been successfully held at the American House, at Canton.

Instead of going to the trains, the sophomores now devoted the leisure time from their studies to track athletics. On October 10th we held a dual track meet, and it was not until the next to the last event that the sophomores obtained a winning lead.

We were fully aware that our material for track athletics was limited, so we devoted our spare time to foot-ball practice. We have upon the field one of the best freshman foot-ball teams that ever represented the Tech. Our opening game we won from Norwood, 6 to 0; and on the following Saturday we defeated the same team, by the score of 17 to 0.

We realize that we have many obstacles to surmount before our graduation day. We are here to share the work and joys of college life. We look forward with pleasure to the years before us at Clarkson Tech. Basing our anticipation on the results already achieved, both in the Tech. and on the athletic field, we confidently expect that the class of 1912 will bring honor and glory to itself and to its chosen Alma Mater.

THE CLARKSON MONITOR.

By CONRAD V. O'MALLEY, '10.

Many a time have seniors and juniors walked the campus of the dear old Clarkson Tech., and many a time have they discussed ways and means for the formation of definite plans which would put inter-class treatment on a thoroughly manly basis; which would insure to the upper classmen the respect which is the heritage of every senior and junior; and, finally, which would foster the high ideals and worthy traditions of the Tech. Although many plans were discussed, for some reason or another they did not materialize. It was left therefore, to the present senior and junior classes, of '09 and '10, to take the initial step.

One afternoon in June last found the upper classmen gathered together in a body. As a result of that meeting six men were appointed, three from each class, and they were empowered to go ahead and carry out the formation of such rules for the conduct of freshmen as would engender in them a certain regard and respect for Alma Mater and the upper classmen; and as gently as possible to make them realize they were freshmen. Not that a freshman is not as worthy of regard as any other man in a college community. No, not at all: only he has not struggled and fought for Alma Mater, and as yet has not fallen heir to all of her privileges, and those rights and immunities which belong to every upper classman by custom and tradition throughout the college world. As a result of this eventful meeting, "The Clarkson Monitor", was established, and on the fifth page of its first issue the following greeting was extended to all students, and more particularly to freshmen:

Greeting.

When a student enters college there opens before him the development of his future career. New impressions and work, new associations and ideas are constantly being thrust upon him. After this initial step has been taken, his first duty is to fall in with the spirit and ideas of the institution with which he has decided to associate himself.

Clarkson Tech. has aims, ideals, and purposes which are elevating, inspiring, and noble; and by the extent to which a man lives up to these aims, ideals, and purposes he forms the mould out of which his future life and character are cast.

Every gentleman should be a student, and every student should be a gentleman, expresses the Clarkson spirit to the very letter. Clarkson aims to send out each year a class of engineers who are proficient, upright, and honorable; and a class that will do credit to its Alma Mater. Therefore, let us labor in a friendly spirit, giving and taking those things most helpful to all and for the betterment of the Clarkson spirit and ideals. Let us aim to make all students gentlemen and all gentlemen students. To him who enters with this purpose, we extend a cordial greeting. To him who enters with a baser and less honorable motive we warn him that he has many obstacles to surmount, many difficulties to overcome; and the quicker he falls into line and adopts these as his ideals, the quicker he will find himself on the road that leads to success and culminates in the graduation of a true Clarkson Tech. engineer.

This little book, "The Clarkson Monitor," is published to foster and develop the Clarkson spirit and the Clarkson ideals, and to further the growth and unification of the School.

Another matter that was brought up in the meeting referred to, was the danger of some one being killed in the annual Chapel rush, due to the fact that the classes are rapidly increasing in size, and that the Chapel stairs are not directly in front of the Chapel door. One can easily see that sooner or later, when the sophomore's line of defense is broken up, the rush of the students is certain to carry some men over the railing instead of down stairs. Inasmuch as the world needs all the Clarkson Men the Tech. can put forth, we decided to abolish the Chapel rush and to substitute a cane rush in its place.

A cane rush did take place! After as strenuous a contest as one could desire to see, when the turmoil had subsided and time was up, it was found that the sophomores had won by having fourteen hands on the cane to the freshmen seven.

"Tech. Night" was also a great success. Every student in the College met on the campus that night. A line of march was formed, and the student body walked through the village of Potsdam, waking things up in general, giving the good old Clarkson Yell, "Ah, Wah, Wie" singing college songs, burning colored lights, etc. The parade then marched one mile into the country to the banks of the Raquette river, where a bonfire had been built and refreshments had previously been provided. Here the entire student body was seated, by class rank, in the form of a Clarkson "C". The freshmen then served refreshments of various kinds. Afterwards various songs were sung, speeches were made, and Tech. feeling rose higher and higher till it could be heard as far as the village. The meeting broke up at 12 p. m., all marching back to the village and dispersing quietly. It is needless to state that Tech. Night was a complete success, and did much for the purpose for which it was inaugurated, namely, the unification of the school body.

Soon thereafter the freshmen and sophomores were pitted against each other in their "Track Meet". After many a valiant struggle to the tape on the part of both classmen the sophomores won out as follows:

INTER-CLASS CONTESTS.

The Freshman-Sophomore Track Meet, October 10, 1908.

Event.	Time, Distances Etc.	Won by.	Class.
100 yard dash...	11 1-5 sec.	1st. Cowie, G. D....	'11
		2nd. Woodworth,...	'12
		3rd. Penny,...	'11
One mile run,...	5:41..	1st. Fox,...	'12
		2nd. Wood,...	'11
		3rd. Alley,...	'12
Running broad jump..	17.975 ft.	1st. Woodworth,...	'12
	17.825 ft.	2nd. Cowie, G. D....	'11
	17.725 ft.	3rd. Cowie, J. C....	'11
220 yard dash.	24 3-5 sec.	1st. Woodworth,...	'12
		2nd. Cowie, G. D....	'11
		3rd. Penny,...	'11
Pole vault.	7 ft. 3 inch.	Maynard,...	'11
		Cowie, G. D. }	'11
		Regan, M. H. }	'11
1-2 mile run.	2:21 1-5	1st. Campbell,...	'12
		2nd. Fox,...	'12
		3rd. Wood,...	'11
Running high jump. ..	4 ft. 11 inch	1st. Penny,...	'11
		Remington, }	'11
		Woodworth, }	'12
440 yard dash.	60 sec.	1st. Woodworth,...	'12
		2nd. Cowie, G. D....	'11
		3rd. Noyes, M. E....	'12
16 lb. Shot put.	28.9 ft.	1st. Regan, M. H....	'11
	28.2 ft.	2nd. May....	'11
	27.7 ft.	3rd. Woodworth,...	'12
1-2 mile relay race...	1:44 1-5	1st. Sophomores.	
		2nd. Freshmen.	

Summary.

Event.	Points.	
	Freshmen.	Sophomores.
100 yard dash.	3	6
1 mile run.	6	3
Running broad jump.	5	4
220 yard dash.	5	4
Pole vault.	0	9
1-2 mile run.	8	1
Running high jump.	2	7
440 yard dash.	6	3
Shot put.	1	8
1-2 mile relay race.	0	5
Total.	36	50

One feature of the work of the upper class committee was to establish a series of events arranged to take place between the freshman and sophomore classes. Also, to inaugurate such other events as would

foster the true Clarkson Spirit and would put the Tech. on a plane with any other college in the country in this respect. As a result of this work the following customs and traditions were listed, many of them already well known to Clarkson Alumni; and the dates for the same settled as far as practicable.

Customs and Traditions.

Hazing.—There is no hazing. Occasionally some individual freshman is made to feel that one can know too much from the start, but hazing is severely condemned as a general practice.

Rushes.—Cane rush immediately after first Chapel, in charge of upper class committee. Flag rush during week following first mid-semester.

Athletic Events.—Freshman-Sophomore track meet, second Saturday in October. Freshman-Sophomore foot-ball game, first Saturday in November. Freshman-Sophomore base-ball game, third Saturday in May.

Freshman Banquet.—To be held before November 1.

Proc. Night.—Shall be held on the first Friday night after registration.

Tech. Night.—Shall be held on the second Friday after registration.

Moving Up Day.—Shall be held the evening before last Chapel exercises.

Thus the little "Clarkson Monitor" was launched into Tech. life decorated with the Clarkson colors, old gold and green, so dear to the hearts of all Tech. men; and with the name "Clarkson" inscribed in gold across the cover. It contains the above rules, regulations and instructions for the guidance of freshmen, supplemented with much of interest to all Techs.

In closing let me state that the little work has achieved its object, and the "Clarkson Monitor" holds a place in every true Tech. heart. Long after the classes of '09 and '10 have left Alma Mater for work which they had the honor of starting, will go on, accelerating and accumulating, as the stream of its life expands more and more in the years to come.

For and in behalf of the Upper Class Committee: H. N. Seffert, '09; E. W. Morse, '09; R. P. Strough, '09; L. W. Wood, '09; G. C. Baker, '10; C. V. O'Malley, '10.

ASSEMBLY AND STUDENT ORGANIZATIONS

CLARKSON ENGINEERING ASSEMBLY. 1908-1909.

Organized, January 19, 1906; Constitution adopted at first annual meeting, Decennial Founder's Day, November 20, 1906, granted Limited Charter by the Regents of the University of the State of New York, May 29, 1907.

Board of Trustees.

To serve for two years, term expires November 20, 1908: G. A. Stebbins, '01; L. K. Russell.

To serve for three years, term expires November 20, 1909: E. B. Brackett; C. Michel.

To serve for three years, term expires November 20, 1910: M. L. Stack, '05; R. L. Safford, '08.

The Director, Ex-officio, Chairman and seventh Trustee.

Upper House of the Assembly.

The seventeen appointive members of the Instructional Force: W. S. Aldrich, B. B. Brackett, C. Michel, W. M. Towle, W. A. Yerzley, S. G. Barton, L. K. Russell, E. B. Wheeler, S. M. Turrill, C. H. Sanford, A. J. Biche, '09; L. J. Gorman, '09; B. W. Morse, '09; L. W. McCullough, '09; W. S. Davis, '10; A. D. Merrill, '10; L. W. Weed, '10.

The eight elective members of the Alumni Association: N. L. Rea, '01; S. I. Wailes, '01; H. F. Halladay, '02; C. A. Pohl, '02; B. L. DeLack, '03; F. C. Zapf, '04; H. S. Dunsford, '05; R. B. Leonard, '06.

Officers: 1908-1909: President, the Director, Wm. S. Aldrich; Vice-President, Professor B. B. Brackett; Secretary, L. W. Weed, '10; Corresponding Secretary, F. C. Zapf, '04; Treasurer, L. W. McCullough, '09.

Lower House of the Assembly.

Seniors: B. B. Burch, H. N. Scofield, R. G. Baker; Juniors: A. A. Griffin, H. G. Corwin, J. J. Merithew; Sophomores: G. D. Cowie, R. E. Gardner, F. E. Ladd; Freshmen: H. E. Hinman, D. F. Noyes, P. H. Woodworth.

Officers, 1908-1909: Chairman, the Speaker, H. N. Scofield; Secretary, G. D. Cowie.

Young Men's Christian Association.

Lloyd W. Weed, '10... ..President.
John L. Maynard, '11... ..Vice President.
Harold G. Corwin, '10... ..Secretary and Treasurer.

Clarkson Tech. Orchestra.

L. E. and G. E. Welker, '09, Managers, and holders of the Musical Scholarships, 1906-1909; G. R. Morse, '11, Secretary; L. W. McCullough '09, Treasurer; J. A. Remington, '11, Pianist, Scholarship, 1908-1909.

Instrumentation.

1st Violin, L. E. Welker; 2nd Violin, H. R. Jones; Cornet, L. W. McCullough; Flute, F. B. Weed; Cello, G. E. Welker; Clarinet, L. W. Weed; Bass, L. H. Sisson; Drums, G. R. Morse; Pianist, J. A. Remington.

CLASS ORGANIZATION. 1908-1909.

Freshmen.

F. B. Weed, President; H. R. Bartlett, Vice-President;
P. H. Woodworth, Secretary; E. C. Burton, Treasurer.
Representatives: Clarkson Engineering Assembly: H. E. Hinman,
(Oct. 1, 1908-1910) D. F. Noyes,
P. H. Woodworth,
General Athletic Council: H. W. Grow,

Sophomore.

M. F. May, President; H. W. Henderson, Vice-President;
P. J. Baron, Secretary; W. F. Penny, Treasurer.
Representatives: Clarkson Engineering Assembly:
(Oct. 3, 1907-1909) G. D. Cowie,
(Oct. 1, 1908-1910) R. E. Gardner,
F. E. Ladd,
General Athletic Council: M. H. Regan,

Junior.

H. R. Jones, President; C. M. Jervis, Vice-President;
 H. M. Merriman, Secretary; G. C. Burrows, Treasurer.
 Representatives: Clarkson Engineering Assembly:

(Oct. 3, 1907-1909) A. A. Griffin.
 (Oct. 1, 1908-1910) H. G. Corwin.

General Athletic Council: J. J. Merithew.
 G. C. Dona.

Senior.

R. P. Strough, President; G. McG. Rodger, Secretary; J. L. Ames,
 Treasurer.

Representatives: Clarkson Engineering Assembly: R. G. Baker.
 B. F. Burch.
 H. N. Scofield.
 General Athletic Council: B. W. Morse.

ENROLLMENT OF STUDENTS. I Semester, 1908-1909.

Seniors...	14
Juniors...	22
Sophomores...	34
Freshmen...	23
Special...	1
Total.....	94

Thomas S. Clarkson

MEMORIAL SCHOOL OF TECHNOLOGY

Potsdam, N. Y.

A College of Engineering for the Training of Men.

This Institution was founded in 1895. It was chartered, March 19, 1896, by the Regents of the University of the State of New York, and opened its doors to students in September of the same year.

The object of the Clarkson foundation is to provide technological education of college grade.

The School is located at Potsdam, St. Lawrence Co., N. Y., on the Rome, Watertown and Ogdensburg division of the New York Central Railroad. It may be reached from all points through the connections of this road in New York State and Canada.

For admission there is required a thorough four year high school preparation. The regular courses extend over four years and comprise instruction in language, literature and history, mathematics, the natural and economic sciences, engineering and technology. The instruction is largely taken in common, during the first two years, and provides the elements of a liberal education. Based upon similar instruction in the fundamental principles of the applied sciences, the subsequent training aims to develop the habit of clear and accurate thinking, familiarizing the student with practical methods of executing work and projects and scientific methods of conducting investigations.

The technical instruction of the last two years, in theory and practice, affords substantial preparation for immediate usefulness after graduation by intelligent application of principles to the successful mastery of the details of the chosen field of work. A foundation is also laid for those who intend, by further study, to specialize in some particular branch of their profession.

The four year courses in engineering afford thorough preparation for those who intend to engage in the professions of chemical, civil, electrical or mechanical engineering. They lead to the degree of Bachelor of Science in the major subject pursued; namely, chemical, civil, electrical and mechanical engineering. The degree of B.S. is conferred and certified by a diploma issued by the Regents of the University of the State of New York, jointly with the Trustees of the Thomas S. Clarkson Memorial School of Technology.

This School is included by the United States Civil Service Commission in the list of approved technical schools, diploma from which entitles the holder to promotion in the Engineer Department at Large; and in the list of accepted institutions entitled to share in the benefits of the Carnegie Foundation for the Advancement of Teaching.

